CLAIMS

Therefore, having thus described the invention, at least the following is claimed:

1. An ultrasound-imaging system, comprising:

means for identifying the impulse response of a transmit channel of the ultrasound-imaging system;

means for selecting a desired transmit channel signal spectrum, the transmit channel signal spectrum defined by an envelope and a transmit center frequency;

means for determining an excitation signal that when applied in the transmit channel produces the selected transmit channel signal spectrum;

means for applying the excitation signal;

means for receiving a reflected excitation signal centered about a harmonic of the transmit center frequency;

means for selecting a desired receive channel filter function to apply to the reflected excitation signal;

means for identifying the impulse response of a receive channel of the ultrasound-imaging system; and

means for formulating a receive channel filter responsive to the desired filter function and the receive channel impulse response.

2. The system of claim 1, wherein the means for selecting a desired transmit channel signal spectrum identifies a desired transmit channel signal spectrum reflective of a symmetric function.

3. The system of claim 2, wherein the symmetric function comprises a Gaussian function.

4. The system of claim 1, wherein the means for identifying the impulse response of a transmit channel determines the impulse response by measurement.

5. The system of claim 1, wherein the means for identifying the impulse response of a transmit channel determines the impulse response by calculation.

6. The system of claim 1, wherein the determining means formulates the excitation signal as a function of the impulse response and the desired transmit spectrum.

7. The system of claim 6, wherein the formulated excitation signal comprises calculating an inverse Fourier transform.

8. The system of claim 6, wherein the formulation comprises performing a deconvolution operation.

9. The system of claim 8, wherein the deconvolution operation uses a Weiner filter.

10. The system of claim 8, wherein the deconvolution operation uses polynomial time division.

11. An ultrasound-imaging system, comprising:

means for identifying the impulse response of a receive channel of the ultrasound-imaging system;

means for selecting a desired receive channel filter function, wherein the receive channel processes a harmonic echo of ultrasound energy transmitted by the ultrasound-imaging system; and

means for formulating a receive channel filter responsive to the desired filter function and the receive channel impulse response.

12. The system of claim 11, wherein the means for selecting identifies a desired receive channel filter that when applied to ultrasound echoes results in a receive signal that can be modeled with a symmetric function.

13. The system of claim 12, wherein the symmetric function comprises a Gaussian function.

14. The system of claim 11, wherein the means for selecting identifies a desired receive channel filter function with a center frequency at a harmonic multiple of a fundamental frequency of an excitation signal.

15. The system of claim 11, wherein the means for identifying determines the impulse response by measurement.

16. The system of claim 11, wherein the means for identifying determines the impulse response by calculation.

17. The system of claim 11, wherein the means for determining formulates a receive filter as a function of the impulse response of the receive channel and the desired receive channel filter function.

18. The system of claim 17, wherein the formulation comprises calculating an inverse Fourier transform.

19. The system of claim 17, wherein the formulation comprises performing a deconvolution operation.

20. The system of claim 19, wherein the deconvolution operation uses a Weiner filter.

21. The system of claim 19, wherein the deconvolution operation uses polynomial time division.

22. An improved ultrasound-imaging system, comprising:

a transducer;

a switch coupled to the transducer, wherein the switch is positioned to apply an excitation signal to the transducer in a transmit mode of the ultrasound-imaging system, the excitation signal having a center frequency;

a signal shaper coupled to the switch, the signal shaper configured to generate the excitation signal, the signal shaper further configured to adjust the excitation signal in response to the impulse response of the transmit channel such that a desired ultrasound energy waveform is generated by the transducer; and

a receive channel signal shaper coupled to the transducer, the receive channel signal shaper comprising a filter, the filter formulated in response to the receive channel impulse response and a desired echo response signal spectrum, the filter further configured to process the ultrasound echo response at a harmonic of the center frequency.

23. The system of claim 22, wherein the transducer has a passband capable of harmonic imaging.

24. The system of claim 22, wherein the desired ultrasound energy waveform generated by the transducer can be modeled with a symmetric function centered at a fundamental frequency.

25. The system of claim 22, wherein the echo response signal spectrum is centered about at least one harmonic multiple of the fundamental frequency of the excitation signal transmitted via the transducer.

26. A method for enhancing the axial resolution and improving transducer response sensitivity in an ultrasound-imaging system, comprising the steps of:

selecting a desired transmit spectrum;

quantifying the transmit channel impulse response;

calculating a drive signal that when applied to the transmit channel will produce the desired transmit spectrum, the drive signal having a center frequency;

applying the drive signal to a transducer;

selecting a desired echo response spectrum;

quantifying a receive channel impulse response;

deriving a filter that when applied to received ultrasound echo signals will produce the desired echo response spectrum at a harmonic of the center frequency; and

applying the filter to the received ultrasound echo signals.

27. The method of claim 26, wherein the transducer has a passband capable of harmonic imaging.

28. The method of claim 26, wherein the desired transmit spectrum generated by the transducer can be modeled with a symmetric function centered at a fundamental frequency of the drive signal.

29. The system of claim 27, wherein the received ultrasound echo signals are centered about at least one harmonic multiple of the fundamental frequency of the drive signal transmitted via the transducer.